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THE SCOTTISH SCHOOL OF GEOLOGY[1]

By Professor FRANK D. ADAMS

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THE celebration of the centenary of the Geological Society of Edinburgh must indeed be an occasion of very especial pleasure for any one who takes an interest in the development of the science of geology. For it was in this city that what has been called the Scottish School of Geology took its rise and for a brief half century, A. D. 1780 to A. D. 1825, made the city of Edinburgh one of the greatest centers of geological learning of the time.

Here it was that Hutton, who may fairly be called one of the founders of modern geology (A. D. 1726–A. D. 1797) was born, lived and wrote his epoch-making work, "The Theory of the Earth." It was here that Sir James Hall, the "founder of experimental geology," carried out his celebrated researches, which gave such valuable support and corroboration to Hutton's explanations of certain phenomena which he had observed in the field. And it was here that Playfair, professor of natural philosophy in the University of Edinburgh, wrote his "Illustrations of the Huttonian Theory," a work on which he bestowed much time and labor and which did so much to elucidate Hutton's views and to present his theory in such a clear and attractive form that it achieved a widespread acceptance.

These were the three great leaders of the Scottish School of Geology, but there were other men associated with them who occupied less important positions and of whose work it is impossible here to make further mention. Hutton being the chief exponent of the views held by this school, his explanation of the origin and structure of the earth came to be known as the Huttonian theory.

Another circumstance which gave an additional impetus to the study of geology in Edinburgh was that about the same time that Playfair was appointed to the chair of natural philosophy at the University of Edinburgh, Robert Jamieson received the appointment of regius professor of natural history at this

[1] Address given at Edinburgh on the occasion of the centenary celebration of the Geological Society of Edinburgh, September 3, 1934.

same seat of learning. Jamieson had studied geology at Freiberg under Werner and, being an able and active exponent of Werner's opinions, promulgated them in Edinburgh and in 1808 founded the Wernerian Natural History Society, in the publications of which Werner's views were set forth and strongly advocated.

There thus arose an active controversy between the supporters of the Huttonian and Wernerian Schools, which led to a close study and active scrutiny of the respective tenets of the two parties, especially as applied to the elucidation of the geology of Scotland. The views of Hutton prevailed over those of Werner in the end, and Jamieson is said to have frankly admitted his conversion to the views of his opponents.

So soon as in Europe the men who were directing their attention to the study of the origin and structure of the earth's crust ceased merely to speculate and turned to actual observation in the field, the course which their studies took was determined very largely by the character of the rocks which were exposed to view in their respective areas. Thus the early Italian geologists, studying the late Tertiary rocks of northern Italy, which contained an abundance of well-preserved fossils very similar in character to the shells of animals living in the adjacent sea, devoted a great deal of attention to the question of the origin of these fossils, whether they were really the remains of animals which had once been alive and if so how it was possible that they were now found high up on the tops of the mountains.

If they lived in southern Italy, the presence of Vesuvius and Etna forced them to consider the question of the nature and origin of volcanoes and their accompanying earthquake phenomena and the bearing of these on the question of the condition of the earth's interior. In like manner the early geologists of France came to devote their studies largely to paleontology, while Werner in northern Germany had his attention directed chiefly to the question of the nature and succession of the stratified sedimentary deposits and the constitution of the geological column, as well as to questions of the origin and classification of the ore deposits for which Saxony and the adjacent parts of Germany were renowned and where mining had been carried on for nearly a thousand years.

And so in Scotland, where undisturbed fossiliferous strata were seldom seen and where there were no volcanoes, the attention of the geologists of the Scottish School was devoted chiefly to the inorganic side of the science. The upheaved, broken and metamorphosed strata, consisting largely of very ancient rocks, often presenting distinct unconformities and penetrated in all directions by igneous intrusions, presented a complex whose study was beset with many difficulties, but which revealed clearly the fact that these rocks in their present form had been the result of a long succession of separate shatterings and upheavals, evidently connected in many instances with the action of deep-seated plutonic forces. Fire, or at least heat, had evidently played an important part in these successive "revolutions." At the same time the clear evidence of the continuous waste of land under the influence of the atmospheric forces, with the production of immense quantities of detritus washed down from the hillsides and eventually finding its resting place in the sea, where it built up new stratified formations which would in their turn be upheaved to form new lands, were to Hutton and his followers a conclusive demonstration that the forces of both fire and water had acted through immense vistas of past time, their succession presenting, to use his celebrated phrase, "no traces of a beginning and no prospects of an end."

The insistence on these views, which are now so well established that they seem almost self-evident, was Hutton's great contribution to the science of geology. They were set forth in his great work, "The Theory of the Earth," and the demonstration of their truth was the glory of the Scottish School of Geology. Incidentally, I may be allowed to narrate a rather amusing little incident in connection with Hutton's "Theory of the Earth." As is well known, it first appeared in the Transactions of the Royal Society of Edinburgh in 1788 and then, enlarged and extended, was published in book form under the same title in 1795. This book consists of two volumes, but the work was incomplete, the treatment of the subject being cut off abruptly at the end of the second volume, the intention being evidently to complete it in a subsequent volume or volumes. This third volume, however, was never published, although there was reason to believe that the manuscript had been prepared by Hutton. This manuscript, however, could not be found.

Upon the death of George Huntington Williams, the very brilliant young geologist who was the first to hold the chair of geology at Johns Hopkins University in Baltimore, his widow founded and endowed a course of lectures to be delivered annually at that university in his memory. Sir Archibald Geikie was invited to give the first course of these Williams lectures and chose as his subject "The Founders of Geology." These lectures were published as the second and enlarged edition of his book which bears that title.

I went to Baltimore to hear these lectures, but did not arrive until the evening of the day on which the first one had been delivered. At a dinner party given in honor of the lecturer on this evening, Dr. Clarke, Williams' successor in the chair of geology at Johns Hopkins University, remarked to Sir Archibald that

he had been much interested in what had been said in the inaugural discourse concerning the missing part of the "Theory of the Earth," and Sir Archibald then gave an account of the search which for years past he had made in every library in which he thought the manuscript might possibly have found a resting place but without being able to find any trace of it.

"Well, Sir Archibald," I said, "I can tell you where it is." Sir Archibald looked at me in blank astonishment and said, "Where is it?" and I replied, "In the library of the Geological Society of London at Burlington House standing on the shelf beside the two printed volumes of Hutton's 'Theory of the Earth,' and on the fly leaf is a statement to the effect that it was presented to the library by Leonhard Horner."

As a matter of fact when reading in this library a few months before the evening in question, on asking for Hutton's "Theory of the Earth" the attendant brought me the two printed volumes and with them a third rather shabby looking volume, remarking that he had found "this old thing" on the shelf beside the others and thought that possibly I might find something of interest in it. On examination it proved to be the long-sought-for manuscript, and I sent a letter to *Nature*, which appeared in the issue of October 10, 1895, announcing its discovery and making a brief reference to its contents. This had escaped Sir Archibald's notice. On his return to England, the Geological Society of London, at his suggestion, had the manuscript printed, and it appeared as Volume III of the "Theory of the Earth." It is to be noted, however, that this manuscript did not contain all the missing portion of the work—there are some additional chapters which are still missing and will indeed be a treasure trove if any one can find them.

It has been suggested that I should make some reference to the relation of British to Canadian geologists in the development of the science of geology.

The Scottish School of Geology played an important part in the development of our science in Canada, largely through the influence of Sir William Dawson and Sir William Logan.

Dawson was born of Scottish parents in the town of Pictou in Nova Scotia and received his preliminary education in the school and academy of that place. He early showed a keen interest in natural history and in 1840 came to Edinburgh, entered the university and became a student of Jamieson's. His experiences as set forth in his brief autobiography throw an interesting light on the conditions of travel and study at that time.

He left Halifax on a sailing ship loaded with timber and bound for Newcastle. The ship was nearly wrecked by a series of violent storms which it encountered and when the last of these subsided found itself off the historic island of Lindisfarne. From there it made its way to Newcastle. Dawson remained but one evening there and that he passed at a meeting of a debating society of young men to whom he had been introduced. He took some little part in the discussion and at the close of the debate, he tells us that he was congratulated on speaking English so well, a fact which recalls to mind a recent observation by Lord Ponsonby to the effect that a Scottish accent is an enormous advantage to a speaker. The members of the club presumably supposed that coming from Nova Scotia his native language was Chippewa, Micmac or some other Indian dialect.

There were no railways at that time in northern Britain, so that next evening Dawson proceeded to Edinburgh by stage and the following morning found himself in the High Street. Jamieson, who was his principal teacher, he says, devoted a large part of his earlier lectures to physical geography and the remainder to minerals and rocks. Dawson remarks that he was surprised later on to find how little even some of the more eminent English geologists of the day seemed to know of mineralogy and consequently how uncertain was their diagnosis in the field of rock masses. "At the same time," he goes on to say, "I regretted that I could not obtain any systematic instruction in paleontology, geological surveying and in some other important subjects." He, however, provided himself with Maclaren's excellent book on the local geology and made frequent excursions in the vicinity of the city.

"While in Edinburgh," Dawson writes, "I received much personal kindness and useful guidance from Jamieson, Forbes, Balfour and other leading men connected with the university. Also from Alexander Rose, an excellent mineralogist, being an authority on the minerals of Scotland and Ireland. It was through him that I was introduced to Mr. Sanderson, the lapidary, who sliced fossil wood for Witham and Nicol, from whom I learned something of the art of preparing transparent slices of rocks and fossils for the microscope which was afterwards of great advantage to me."

Having completed one academic session at Edinburgh, he was obliged to return to Nova Scotia, but went back to Edinburgh and resumed his studies in 1846.

Dawson, on his return to Nova Scotia, was appointed to a position as school inspector, which required him to pay repeated visits to every part of the province. In so doing he acquired a knowledge of the geology of the whole of what now constitutes the Atlantic Maritime Provinces of Canada, which he set forth in his great volume entitled "Acadian Geology." During this time he met two great geologists, both of whom had a marked influence on his later career; these were Lyell and Logan. Lyell, on

the occasion of his first visit to America in 1841, spent some time with him. With Dawson he visited the celebrated section through the coal measures exposed along the coast of the Bay of Fundy as well as other parts of the coast line of that province, where Lyell was especially anxious to study the action of shore ice, as he was a strong adherent of the theory that the Post-Pliocene glaciation was due to shore ice and had not been able to get any evidence in support of this theory in his examination of the interior portion of the continent, although he had diligently sought it everywhere.

Lyell tells us how delighted he was to find in the cliff at the foot of Cape Blomidon a great groove which had undoubtedly been made by floating ice.

The other geologist mentioned by Dawson as having greatly influenced his career was Logan. Logan was born in Montreal and received his earlier education in that city and in the high school at Edinburgh. He then entered the University of Edinburgh, where he graduated, with distinction in mathematics in A. D. 1817. In A. D. 1831 he became connected with the coal-mining industry in Wales and made a geological map of the South Wales coal areas which he presented to Sir Henry de la Beche and which was by him issued as a publication of the Geological Survey of Great Britain. Later Logan returned to Canada to undertake some geological work in the Gaspé Peninsula and eventually became the first director of the Geological Survey of Canada, having its headquarters in Montreal.

By his own untiring labors and with the assistance of his colleagues through a long series of years he made a most valuable contribution to geology in his description and classification of the ancient pre-Cambrian rocks of the Canadian Shield, giving to us the Laurentian and Huronian systems, but he also founded the Geological Survey of Canada, which has been continuously at work ever since and to which we are indebted for most of our knowledge of the geology of that greatly extended area which now constitutes the Dominion of Canada. Being, furthermore, a man of large private means in that day of small things when the Geological Survey of Canada was in its infancy, he provided from his own private purse a not inconsiderable part of the financial support required to maintain the Survey in question until the government came to recognize the great benefit which it was rendering to the country and provided adequately for its continuance.

In A. D. 1855 Dawson left Nova Scotia and went to Montreal to assume the position of principal and professor of geology in McGill University. He worked in close cooperation with Logan for many years, who, recognizing the necessity of training up young geologists to undertake the geological mapping of the Dominion, endowed the Logan chair of geology in McGill University held by Dawson and also made provision in other ways for the teaching of geology at this seat of learning.

And so it came about that in the early years of the Geological Survey of Canada it was Dawson's students who carried out much of the actual work of the Survey, and Sir William Dawson's son, George Mercer Dawson, at a later date became its director and continued with great distinction the work so ably inaugurated by Sir William Logan himself. Thus the influence of the Scottish School of Geology made itself directly and widely felt across the sea.

Sir William Dawson was an honorary fellow, and both Sir William Logan and Dr. George Mercer Dawson were foreign corresponding fellows of the Geological Society of Edinburgh.

In conclusion, the present speaker may perhaps be allowed to say that, having received his early training in geology from Sir William Dawson and having succeeded him in the Logan professorship at McGill University, he too is proud to feel that any small contributions which he has himself been able to make to geological knowledge have in some humble and remote way been influenced and inspired by the teaching of Jamieson and his colleagues in those far-off days when we might almost say that British geology took its rise here in Edinburgh.

SUMMARY STATEMENT OF THE WORK OF THE NATIONAL RESEARCH COUNCIL, 1933-1934

By ISAIAH BOWMAN
CHAIRMAN

THE work of the National Research Council during the past year has called for an extension of associative effort into a number of new fields. The details will be found in the Annual Report for the year 1933–34, which will be published at the customary time. It has been thought advisable to publish a brief preliminary account of some of the recent major enterprises of the council for the immediate information of the public. They fall into five main classes:

(1) Aid to research through organization.
(2) The advancement of specific pieces of research.
(3) The advanced training of talented personnel.

(4) Selected projects that receive support for laboratory equipment, technical assistance and field work through special grants.

(5) The maintenance and improvement of relations of scientists of different countries.

By persistent and intensive study of the several fields of science the Research Council attempts to locate the most critical points of attack upon these several problems, to furnish the organizational basis for such an attack, and to throw its judgment and the relationships at its command into the effort to secure supporting funds. The council was organized over fifteen years ago to do these things because science had become so widely extended that good working relations between the parts and the maintenance of a certain necessary parallelism of advancement seemed to require general consideration by groups organized into divisions. Scientific progress has received such consideration in the past, but it is clearly better to do it systematically. No one who has done constructive work in science has failed to receive benefit from the exchange and correlation of ideas. More and more the borderlands between the classical branches of science have furnished the richest soil. Biology in relation to medicine, on the one hand, and to physics and chemistry, on the other, forms a convenient illustration.

The council also has the legal obligation of cooperating with the several departments of government. One of the agencies in such cooperation is the Division of Federal Relations; a new one was established on July 31, 1933, through the appointment for two years by President Roosevelt of the Science Advisory Board.

Particular attention has also been given during the past year to a study of borderlands in science. Provision has been made for the further discussion of the two borderlands of biophysics and biochemistry. A special meeting of the Administrative Committee will be called in the autumn of 1934 to discuss such borderlands in greater detail and to come to a judgment with respect to related projects which seem to occupy an important place in advanced research. In the meantime support has been given to the proposal for the establishment of an Institute for Biophysics whose purposes are "to promote research in the field of quantitative biology."

A sum of $10,000 has been given to the council for the expense of a survey of research in the field of mitogenetic radiation and for certain additional exploratory investigations. As a result of a conference held last February a program of research has been promulgated which will be carried on at the University of Wisconsin, the University of Rochester, Cornell University and Washington University, St. Louis.

Another borderland of science is illustrated by the general term "land-use." Concerned with this problem are specialists in climatology, soils, agriculture, geology and geography. A committee on land classification has been established in the Division of Geology and Geography in order that refinements may be made of terminology and techniques of classification adapted to the several regions of the United States. In addition the council has cooperated with the Science Advisory Board in calling a conference of Government officials to consider the scientific objectives appropriate to a national program of land-use. In the first annual report of the Science Advisory Board will be found a statement regarding this conference. The cordial cooperation of the government was secured in discussing the scientific aspects of land-use and a report on land problems that had been prepared. There was informing and useful discussion of the principles which should guide the development of such a program. Provision has been made both in the council and the Science Advisory Board for a further study of the general aspects of this important question. One of these is the ecology of grasslands. A committee of the council has formulated a plan of study of the grasslands in various typical parts of the United States, involving setting aside a number of selected areas for observation in connection with the projected studies.

In the administration of the three series of post-doctorate fellowships of which the National Research Council has charge (*a*, for physics, chemistry and mathematics; *b*, for the medical sciences; and *c*, for the biological sciences), the council has this year given special attention to the methods of administering these fellowships and the results which have come from the council's fellowships program in relation to the educational and social needs of the country. This study on the part of the three boards has been coordinated through an Advisory Committee on Fellowships. The boards themselves held a joint meeting last April for the discussion of the value of this form of assistance to research.

To the Research Council it appears that an additional year or two of training and experience in research given to men and women selected from among the best of those who have recently taken the doctor's degree affords an unparalleled means for the development of investigators who give promise of becoming leaders in science. Nor is this an assistance which can be offered once or during a limited period of years only. The need for this kind of assistance at this level in the development of scientific leaders is continuous if this country is to maintain its scientific momentum and advance the ideals of research attainment in scientific fields.

The Rockefeller Foundation, which has supported

these fellowships generously, has provided funds which have made possible the appointment of about 150 fellows under these three boards during the past year. The boards are studying upon means for sharpening their selection of applicants and for making the administration of these fellowship systems more fully meet the possibilities in them. The achievements of past fellows in their professional careers and the influence which the fellowships seem to have had upon the research life of the country, however, convince the council of the continuing value of this stimulus to the advancement of science and encourage the members of the boards to contribute enthusiastically their efforts to increasing the research resources of the country in this way.

For the past five years the Research Council has also been given funds (now totalling $370,000) by the Rockefeller Foundation for the direct support of scientific investigations through the making of research grants. Over 100 such grants were allocated last year, making a total of 580 grants given altogether during the five-year period. The results of the grants thus far made leave no doubt with the council of the desirability of keeping available a certain amount of money from which timely assistance in moderate amounts can be given to augment other facilities in the hands of investigators. The use of certain funds for research grants is believed to be fully as justifiable an application of money in the interests of science as the maintenance of research fellowships. There is appearing also a close relationship between the two in that, with increasing frequency, it is past fellows of the council whose work has merited a research grant upon request from this source. As with the fellowships, the council has been closely studying this year the methods and conditions of making a general research fund, applied to the individual needs of investigators, serve the progress of scientific knowledge as effectively as possible.

In the field of medicine there have been three significant studies that deserve special mention. First to be noted is the conference on tropical medicine that was called under the auspices of the National Research Council on February 5 and 6. It was attended by representatives from over 25 institutions. There was emphasized at this conference the scattered nature of the work in tropical medicine now under way in different institutions in the United States and elsewhere, and there was unanimous agreement that the desired advances in this particular field can now be best made through cooperative effort. A general need was recognized for some new type of organization whereby exchange of information and discussion of advanced means of attack might take place under favorable conditions. Agreement was reached that an Academy or Institute of Tropical Medicine might serve these purposes and elicit general support. Various alternative modes of organization are now under discussion and the outlook is promising with respect to support after an agreement has been reached with respect to an acceptable type of organization. There is no need to dwell on the importance of this developmnt in a branch of medicine in which great advances have been made but in which also so much remains to be done before the effort to conquer tropical diseases can be said to be organized on a scale adequate to the needs of humanity.

In previous reports notice was given of satisfactory progress in two major undertakings of the Division of Medical Science—studies in drug addiction and in sex research. Announcements concerning progress in these two fields must be conservative in nature, and it must suffice, therefore, to say that the results have matched expectations. Organized with a definite laboratory group for investigation upon the purely chemical aspects of the problem at the University of Virginia and with another laboratory group at the University of Michigan for investigations upon the physiology of narcotic drugs, the study of non-habit-forming drugs has advanced to the point where a great and we believe a permanent stimulus has been provided for a continued study of that branch of chemistry which deals with this subject and which for some reason has lagged behind the advances in other branches. Not only has a continuing stimulus been provided, but we can now say that definite results have been obtained. If we can not be equally specific about results in the field of sex research it is because this type of research is of a peculiarly difficult character. Enough has been accomplished to show that the possibilities of useful work in this field are extremely large and that the work now under way has demonstrated both the need and the opportunity for a basic attack upon this fundamental problem.

The results of the program of investigations upon narcotic drugs during the past five years have already distinctly advanced our knowledge of the analytical and synthetic chemistry of this class of substances, have created a center in this country for research on narcotic alkaloids, and have produced a number of new substances which upon being tested physiologically seem to have beneficial properties which, with further study, may make them of use in the curative treatment of drug addicts and for other legitimate purposes in medicine for which only the former habit-forming drugs have hitherto been available.

In the field of research in problems of sex the results of work during the past twelve years, which is being continued for the coming year supported by a grant of $65,000 from the Rockefeller Foundation,

have included the publication of over 700 articles by the collaborators in these researches. More important for the future of science, however, is the development during this period at a score of institutions about the country of laboratories competent in personnel and equipment to carry these and related investigations further. Previous work under the program of the committee in charge of this work has dealt largely with the physiology of sex. The program for the coming year will give increasing attention to the neurophysiology, psychobiology and psychopathology of the phenomena of sex.

In any summary of the year's operations notice must be given of the satisfactory progress of a major undertaking in psychiatric research. Through the cooperation of more than a score of experts there has been prepared a substantial report upon the status of research in this field, the objectives which are sought and the probable lines of attack which experience has indicated upon the large and growing problems of psychiatry in our ever-changing society. This report has just been published. It is believed to be one of the first comprehensive reviews of the contributions which can be made to psychiatry from such basic fields as neurology, pharmacology, endocrinology, serology, general and experimental psychology, clinical psychology, cultural anthropology and heredity.

One of the major undertakings of the council is the publication of *Biological Abstracts*. This rapidly growing branch of science has an almost paralyzing quantity of literature, and in recent years there has been increasing interest in the means whereby the laboratory results in this field can be most effectively disseminated among those whose work would benefit from a knowledge of advances in related fields. Biology and medicine are in the most intimate association, and biology has had to depend to an increasing degree also upon discoveries and techniques in the field of physics and chemistry. The subject stands, therefore, in a position midway between the physical sciences and the broad field of medicine. If it represented pure research with no thought of immediate applications to human welfare the struggle of the scholars for better organization of printed output might make less appeal. It happens, however, that many of the discoveries in physics and chemistry bear on the field of medicine only to the extent to which they are channeled by specific biological researches. Since good health is so fundamental to human welfare, the service which biological research renders it in an ultimate sense is a matter of general concern. Viewed in this light, *Biological Abstracts* should not be judged solely on the basis of convenience, but it should be recognized that in a very necessary way this journal relates pure biology and the inorganic sciences of chemistry and physics through medicine to human welfare, and it supports these relationships withal in a way which promotes discovery in each of them. The question of the continuance of *Biological Abstracts* is therefore not the responsibility alone of one specialty, or of a single field of science, but is a matter of general concern for all men engaged in the advance and application of these several fundamental sciences. It is hoped that before the end of a year a judicial estimate may be arrived at of the relative value of the abstracting journal in relation to research, the opinion being quite widely held that though the cost of producing *Biological Abstracts* is high, it is no higher than the value of the publication, even when measured by the yardstick of research, to say nothing of education.

There is a feeling on the part of some scientific men that the field of engineering represents a collateral line of endeavor rather than a main branch of science in the sense in which physics and chemistry are so considered. It is thought by such men to represent exclusively the application of scientific discovery rather than discovery itself. While applications of science to practical affairs engage the greater part of engineering effort, it is nevertheless true that substantial pieces of research are carried on by engineers, and the council has been fortunate in having had the cooperation of many engineers in enterprises of which a few may be noted at this point. We take for granted the abundant material things of life and their steady improvement to so large a degree that we do not appreciate how relentless is the effort of engineers to improve both the materials and the methods of construction that are found to be deficient for one reason or another. Conspicuous among such enterprises has been the progress made in both the technique of welding and the fundamental understanding of causes for difference in welding techniques at a time when the applications of welding to construction of many kinds have become varied and extensive. The insulation problem has been attacked with equal vigor and success. The same may be said of research on highway construction carried on with the cooperation and financial support of the Bureau of Public Roads. The studies in the corrosion of iron pipe, in which the Division of Chemistry and Chemical Technology stands in an advisory relation to the National Bureau of Standards, may also be mentioned among the promising lines of attack. It recalls the studies made by the bureau during the past five years on the deterioration of paper with advisory assistance from this division of the council, with funds supplied by the Carnegie Corporation.

The council has concerned itself during the past year in a special way with its relation to the Inter-

national Scientific Unions. These have now reached a state of development which calls for a specific group of operations of distinct value to science. Unhappily, the expenses of membership in the several unions had to be met by the National Research Council during 1932 and 1933 out of diminished income, and it became evident by the summer of 1933 that dues could no longer be paid by the council. An effort was thereupon made to have the government of the United States resume payments, not on the basis that served prior to 1932 but on the basis of special congressional action. A bill was introduced in Congress by Representative Sol Bloom, of New York, authorizing the payment of such dues normally in the amount of approximately $5,000 and now nearly 50 per cent. higher. Through the work of Representative Bloom and his associates in the House Committee on Foreign Affairs and through the cooperation of a number of senators the bill was favorably reported to both houses of Congress where it passed unanimously and ultimately received the signature of the President. It is hoped that in the ensuing Congress a suitable appropriation will be made. The effort to pass the bill was marked by a hearing before the House Committee on Foreign Affairs, when over twenty scientific men appeared before the committee and testified to the value of the unions in acquainting scientific men with the progress of science in other countries. The testimony was printed in the report of this hearing as a Congressional document.

The International Scientific Unions, under whose auspices the several scientific congresses are held, deserve the support of every scientific man. They perform a highly useful and important service in improving international relations. To take a single illustration, the International Geographical Congress of 1931 had about 900 members, of whom about 500 were in attendance, representing 40 countries. Such an association is one of many that serve to extend acquaintance and the exchange of results among professional men. The unions also provide the basis for an orderly and authorized organization of scientific congresses when they meet in a given country, a national committee being appointed in each case under whose control arrangements are made. A third point may be mentioned: commissions of these unions are appointed whose work is continuous between congresses. Through these commissions there is free and useful exchange of field and laboratory results that bear upon selected problems of science which, by international agreement, are considered to be of high, if not of first importance. Finally, it may be mentioned that for the past year six of these seven international organizations to which the council has adhered have had American presidents, and the participation of scientific men in the United States and the support of our government are, therefore, especially important at this time. For the International Congress of Geography held in Warsaw in August, 1934, a cartographic exhibit was prepared that included representative work both from government bureaus and from non-governmental scientific and educational institutions throughout the country. The cartographic exhibit at this congress was the greatest that has ever been prepared and the published description of it will be a permanent document of continuing future value.

During the past year the Division of Anthropology and Psychology has been able to do a piece of work which may be cited because of the striking nature of the results. Dr. A. E. Morgan, of the Tennessee Valley Authority, invited the chairman of the council to draw the attention of archeologists to the loss of important archeological material in the Tennessee Valley when the dams projected would become reality and valley sites would be inundated. Through the chairman of the Division of Anthropology and Psychology a plan was made, the support of the Carnegie Corporation was secured, C. W. A. and state relief personnel was employed and the artificial basin sites were thoroughly examined. At one time about a thousand men were engaged in the work. A number of domiciliary mounds have been found in the Norris Basin, and in the Wheeler Basin, where earlier work had already been done by the Alabama Museum of Natural History, several shell mounds have been excavated on islands in the Tennessee River. It is expected that both of these basins will be flooded within two years. The movable relics of their ancient inhabitants will, however, have been transported for preservation and study at suitable centers of archeological research.

Mention may be made of cooperation with the Science Advisory Board. This board was appointed on July 31, 1933, to cooperate with the National Research Council and, in the language of the executive order, its purpose was "to carry out to the fullest extent the intent" of the executive order of May 11, 1918, establishing the National Research Council. In accordance with the President's instructions, the National Research Council proceeded to do its part in the development of the work of the several committees appointed by the board to deal with problems in the government. Each division has participated to some extent in undertakings appropriate to its interests, and thus the council has been able to contribute its share in an emergency of national scope.

In addition to the matter mentioned above, each division of the council has engaged in other activi-

ties, all of which are important but which can not be enumerated here on account of lack of space. The details of these operations will be found in the Annual Report of the council, which will be published in the Annual Report of the National Academy of Sciences and in the first Annual Report of the Science Advisory Board, which will be published later this fall.

OBITUARY

KARL FREDERIC KELLERMAN

IN the death of Dr. Karl Frederic Kellerman at Garfield Memorial Hospital in Washington, D. C., on August 30, 1934, agricultural science lost a very productive investigator in the biological field and an unusually able administrator of a wide range of research, regulatory and service projects. Born in Göttingen, Germany, on December 9, 1879, while his parents, the late Professor W. A. Kellerman and Mrs. Kellerman, were temporarily there, his childhood and youth were largely spent at Manhattan, Kansas, and Columbus, Ohio, where his father held the chairs of botany in the Kansas Agricultural College and the Ohio State University. He was graduated from Cornell University in 1900 with the degree of bachelor of science and served there for one year as an assistant in botany before entering the then newly organized Bureau of Plant Industry of the U. S. Department of Agriculture in 1901 as assistant physiologist.

His next fifteen years were devoted largely to research in the fields of water supply purification and soil bacteriology, at first in association with Dr. George T. Moore and later in full charge of the bureau projects in those fields, the scientific results of which appeared in numerous publications of the Department of Agriculture and papers in technical journals. Practical methods now widely used for preventing the growth of algae and certain pathogenic bacteria in water supplies were developed, and improved methods of bacterial inoculation of leguminous crops were worked out and widely adopted by practical farmers.

In 1914 Dr. Kellerman became assistant chief of the Bureau of Plant Industry and in 1917 was made associate chief, in which capacity he served until recently transferred to the Bureau of Entomology and placed in charge of the work involved in the eradication and control of plant diseases, activities also assigned to that bureau which is now known as the Bureau of Entomology and Plant Quarantine.

While available space and present circumstance prevent the adequate setting down of the results of the twenty years of his active and productive life in the administrative field, as is contemplated for later recording, a continuing, intimate, personal association with him and his work during this period is the basis for the conviction that few public servants of our generation have rendered such able, energetic and productive service as he. Under his leadership, as chairman of its editorial committee, which responsibility he carried for ten years, the *Journal of Agricultural Research* was organized and established in 1913. For ten years, beginning in 1914, he served as a member of the Federal Horticultural Board during the formative period of national plant quarantine development and enforcement. In 1915, when the discovery was made that the introduced citrus canker disease had gained foothold at a number of scattered points in the orange and grapefruit producing regions of the Gulf States, under his vigorous and capable leadership there was developed and successfully carried through the cooperative research and regulatory program through which the causal organism was promptly determined and the pest brought under control, thus saving this highly important and valuable industry. The successful carrying through of this project, which at the outset was by many scientists and administrators regarded as hopeless, required the highest type of administrative courage and faith in the loyalty of cooperating associates both in laboratory and field. Recognition of the essential basic principles which were crystallized out through this campaign was of great value in the guidance of other emergency eradication projects which followed.

In 1917 Dr. Kellerman was designated by President Wilson as a member of the National Research Council, serving as secretary of the agricultural committee, and from 1918 he served as a member of the division of biology and agriculture and of the division of federal relations. In 1929 he organized the phony peach disease eradication project in the South and shortly before his death the Dutch elm disease eradication project in the Eastern States.

Among his associates Dr. Kellerman was a most highly regarded counselor and friend, the wholesome and stimulating effect of whose personality upon hundreds of scientific workers is widely recognized by the workers of the department and the state experiment stations. In the planning of research undertakings he possessed unusual clarity of vision, ability to locate the essential objectives and to work effectively with men of widely divergent training and temperament, as is frequently necessary in the public service. Inherently logical in his mental processes and honest in thought and expression, he was an un-

deviating power for good in both scientific research and business administration. Once he was satisfied that a proposed course of action was honest and essential to the public interest, he was unflinching in oral and written expression and in action with regard to it. Loyalty, courage, patience and intensive, persistent effort were conspicuous elements in his life. One who knew him well in the later years, during which much of his most productive and important work was done, has said:

> I think it was his courage for which I admired him most. . . . It was his own peculiar and personal kind—it was quiet, it was never spectacular, it was imperturbable, it was calm and unflinching in defeat, without trace of arrogance in victory. His wise, unselfish counsel has helped scores, probably hundreds, among his scientific acquaintances. His research ability and his skill as an administrator leave science and society deeply in his debt. His courage as an individual, which approached the absolute, was a moral force which his death does not extinguish.

He was actively interested in the work of a number of the national and local scientific societies, a member of Delta Upsilon and Sigma Xi fraternities and an active member of the Cosmos Club and the Columbia Country Club of Washington.

In 1923 the Kansas Agricultural College conferred upon him the degree of doctor of science in recognition of his work in plant physiology and pathology.

Dr. Kellerman is survived by his wife, Mrs. Gertrude (Hast) Kellerman, his son, Karl Frederic, Jr., his grandson John, his mother, Mrs. Stella V. Kellerman of San Diego, Calif., and two sisters, Dr. Ivy Kellerman Reed and Mrs. Walter T. Swingle.

WM. A. TAYLOR

BUREAU OF PLANT INDUSTRY

RECENT DEATHS

DR. FREDERIC SOWDEN JONES, associate member of the Rockefeller Institute for Medical Research, with headquarters at the Department of Animal and Plant Pathology at Princeton University, died on October 19. He was forty-six years old.

DR. FRANCIS METCALF ROOT, associate professor of medical entomology at the Johns Hopkins School of Hygiene and Public Health, died on October 21 at the age of forty-five years.

DR. JOHN H. BANKS, New York geologist and metallurgist, died on October 3 at the age of seventy-three years.

GRACE POTTER RICE, assistant professor of chemistry at Barnard College, died on October 18 at the age of fifty-two years.

SANTIAGO RAMÒN Y CAJAL, the distinguished neurologist and histologist of Madrid, died on October 18 at the age of eighty-three years.

SCIENTIFIC EVENTS

LOCUST CONTROL IN AFRICA AND ASIA

THE third International Locust Conference opened in London on September 11. Simultaneously with the meeting of the congress the sixth report of the Committee on Locust Control of the British Economical Advisory Council has been issued as a white paper.

According to a summary in the London *Times*, the committee, of which Sir Henry Miers is chairman, reviews the present locust outbreak in Africa and Western Asia and the investigations carried out since 1929 and ends with a note concerning further investigations. There are appendices dealing with anti-locust aircraft experiments in Northern Rhodesia and the fungus disease of locusts. Four varieties of locust are dealt with in the report, the Tropical Migratory, the Desert, the Red and the Moroccan locusts.

In its general conclusions the committee says:

> The truly international character of the locust problem has never been demonstrated on so large a scale or in so convincing a manner as during the outbreak which began nine years ago and is still in progress. Thus, in the astonishingly short period of five generations, the tropical migratory locust was able to cross Africa from west to east. In the course of the next three generations it spread over the whole of East Africa, and crossed the continent diagonally from northeast to southwest. Turning to the desert locust, we find that the breeding of this locust in the remote regions that lie to the south of the Sahara is closely connected with the invasions of the fertile coast lands of the African shores of the Mediterranean. Again, we find that invasions of Egypt, Palestine, Syria, Turkey, Iraq, Persia and, perhaps, India are dependent on the situation in Arabia and the Sudan, and that the locust problem in the territories of East Africa is intimately bound up with that in Somaliland.
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> The present locust outbreak, especially in Africa, developed on so great a scale that it soon became apparent that attempts at its general control would be doomed to failure. . . . Even in those territories where the extermination of invading locust swarms and of their immediate progeny was possible, though costly, the success attained was limited to the saving of the crops of a single season. No immunity for the future was secured. Fresh campaigns had to be organized in following years to meet the threat of fresh invasions.
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> Thus, from this point of view, the chief lesson of the last few years has been the realization that in tropical and sub-tropical Africa and Asia it is impossible to control a locust outbreak once it has been allowed to spread

over a large area. . . . There is reason to suppose that, even if every territory were to adopt the most modern methods of control and to organize a highly efficient service, they would still be powerless to affect materially either the general development or the extent of a locust outbreak once it has developed on a considerable scale.

It has sometimes been argued that the present locust outbreak is unprecedented in its extent and that it is unlikely that so formidable an attack will occur again. All the available evidence, however, points to the opposite conclusion. . . . It may, therefore, be confidently assumed that far from being less serious, locust invasions in the future, if allowed to develop, will be even more disastrous than that through which we are now passing.

There is nothing to lead us to suppose that the remote districts which serve as the permanent breeding places of locusts are likely to suffer any natural changes which would cause them to cease to produce locusts. Thus, unless the problem can be solved by the effective control of the breeding areas, there is every likelihood that as larger areas come under cultivation in Africa there will be a proportionate increase in the losses sustained by reason of locust invasions. Even in the present outbreak the losses, direct and indirect, have amounted, we estimate, to at least £7,000,000, and this figure may be well greatly exceeded during the next outbreak.

One of the most important of the results so far obtained is the discovery that the distribution, breeding habits and migrations of locusts which formerly appeared so capricious in character are, in fact, subject to definite regularities. Thus it is now known that each species of locust is restricted in its occurrence to a vegetation zone of a definite type. Again, the migrations of swarms from and to the breeding areas are now known to be regulated by seasonal climatic changes. . . .

If, therefore, the permanent breeding places were known and were kept under regular observation, it should require but little expenditure of time or money to control swarms immediately they began to form after the transformation of the locusts from the solitary to the swarming phase. Control of this type, once established, would at last rid Africa of the constantly recurring risk of devastation by locusts. . . . It is in the hope of providing a solution to this problem that we have devised the experiments in the use of aircraft against locusts that are now being carried out in Africa.

THE AMERICAN TREATY ON THE ROERICH PACT

PRESIDENT ROOSEVELT has appointed Secretary of Agriculture Henry A. Wallace as United States plenipotentiary to sign the Inter-American Treaty on the Roerich Pact, for the protection of artistic, scientific, historical and cultural monuments. This treaty has been drawn up by the Pan American Union in accordance with the unanimous resolution of the Pan American Conference at Montevideo recommending that all the American governments adopt the Roerich Pact for the protection of culture.

In regard to this appointment, Secretary Wallace issued the following statement:

I am deeply gratified to have been named by President Roosevelt to sign for the United States this important document in which I have been interested for many years and which I regard as an inevitable step in international relations.

The Roerich Pact, which forms this treaty, provides that all museums, cathedrals, universities, schools, libraries and other cultural sites be registered by the nations and marked by a banner—known as the Banner of Peace—which designates them as neutral territory respected by all signatory nations. This pact owes its conception to the versatile genius of Nicholas Roerich, one of the greatest figures and true leaders of contemporary culture.

In many ways the history of the Roerich Pact is analogous to that of the Red Cross which was accepted only after sixteen years of effort. But, as Roerich has written, "where the Red Cross cared for the sick and physically wounded, the Roerich Pact protects the values of human genius, thus preserving the spiritual health of the nations."

The Roerich Pact represents thirty years of tireless effort on the part of Nicholas Roerich. In 1904 after several archeological expeditions he first presented his project for the preservation from destruction of the irreplaceable historical and cultural sites of the nations. In 1929 after his return to America from his Central Asiatic Expeditions, he formulated his project into the Roerich Pact. Three conventions have been held for its promulgation—two in Belgium and the third last November in Washington, when 35 nations officially participated. Following this, the Pan-American Conference in Montevideo unanimously recommended the Roerich Pact for adoption by the American Governments and on this basis the present treaty has been drawn up for signature by the Pan American Union.

At no time has such an ideal been more needed. While the individual nations are working out their separate economic and national problems, it is also necessary that they recognize their responsibility as part of the community of nations. I am not one to urge visionary substitutes in the place of effective action in a world of hard economic facts. Yet I do say that it is high time for the idealists who make the reality of to-morrow to rally around such a symbol of international cultural unity. It is time that we appeal to that appreciation of beauty, science and education, which runs across all national boundaries to strengthen all that we hold dear in our particular governments and customs.

It is for this reason that I regard the ratification of the Roerich Pact as so significant a step. Its acceptance signifies the approach of a time when those who truly love their own nation will appreciate in addition the unique contribution of other nations and also do reverence to that common spiritual enterprise which draws together in one fellowship all artists, scientists, educators and the truly religious of whatever faith.

I feel that this age owes a great debt to Nicholas Roerich in the creation of this ideal—for such ideals

alone afford reality to our efforts for creating material wealth and working out improved social machinery for its distribution. While we work out these myriad individual problems, we must have a unifying principle to which all our hearts can give supreme allegiance. In this way we can work with faith and anticipation towards those spiritual and cultural realities of which the Roerich Pact is a symbol.

SOIL AND CROP SURVEYS IN THE TENNESSEE VALLEY

A CHECK-UP on the crop-producing possibilities of the soils of the Tennessee Valley has been started with work begun on a soil survey of Jefferson County, near Nashville, Tenn. The work will be carried on by the Tennessee Agricultural Experiment Station and the U. S. Department of Agriculture Soil Survey. In addition to the usual soil survey program, Dr. C. A. Moores, director of the State Experiment Station, and Dr. J. C. McAmis, of the TVA Agricultural Division, have planned to supplement the usual program with a detailed crop survey.

These new soil surveys will be used by the Tennessee Valley Authority in planning land use in agriculture in connection with its general program of development. The crop survey will report the present use of the land and the yields under present methods, and will also include estimates on what the land could yield if it were planted to other crops and managed according to the methods that have proved most profitable and practical in using other soils of the same type in that vicinity. The reports will also include results of practical experience in applying fertilizers to the various soils.

Some eroded lands, for example, will probably be classified as best suited to production of timber, others for seeding to meadow and pasture. Farmers will have the results of practical experience of other farmers with similar land in getting out of the soil the best net results and at the same time conserving the fertility of the soil, and conserving the soil itself against destructive washing.

Dr. Charles E. Kellogg, acting chief of the Federal Soil Survey Division, reports that agronomists of the Tennessee Experiment Station will make a special study of crops in the region and will catalogue the results on the basis of the soil types on which the crops are grown. J. W. Moon, of the Soil Survey staff, has been assigned to assist in the soil mapping and W. E. Hearn, senior soil scientist, who has been surveying soils proposed for development as subsistence homesteads, expected to join him.

THE LEONARD WOOD MEMORIAL FOR THE ERADICATION OF LEPROSY

THE Leonard Wood Memorial for the Eradication of Leprosy announces aid for investigation in its field of interest for the current year as follows: The support of the Memorial Laboratory, completed and equipped last year in the leper colony of Culion, P. I., under the direction of Dr. H. W. Wade has been continued. Additional facilities have been furnished the Eversley Child's Treatment Station and the Cebu Skin Clinic built by the memorial, presented to the Philippine Health Service, supported by the latter and directed by Dr. José Rodriquez. The support of the *International Journal of Leprosy* now in its second year of publication has been continued.

In addition to these early commitments of the memorial certain research grants have been made for the current year on recommendation of its Medical Advisory Board:

To Dr. Charles M. Carpenter, of the University of Rochester, for his study of the effect of radiothermic treatment on leprosy;

To Dr. E. V. Cowdry, of Washington University, St. Louis, for study of the histophysiology of the lesions of leprosy, particularly by the method of micro-incineration;

To Dr. Esmond R. Long, of the Henry Phipps Institute in Philadelphia, for a comparative study of acid-fast bacteria;

To Dr. C. A. Mills, of the University of Cincinnati, for a preliminary survey of the effect of climate on the incidence of leprosy, and,

To Dr. M. H. Soule, of the University of Michigan, for a study of the methods of blood culture in tuberculosis and leprosy.

In addition to these specific items of financial support the officers of the Leonard Wood Memorial are aware of a rapidly growing interest in the age-old but still baffling disease, to the solution of which its efforts are committed. Several self-supporting studies have been carried out or are in progress in which this foundation has been of service in an advisory capacity, or to which its very existence has furnished the initiating impulse.

WORK OF THE ROCKEFELLER FOUNDATION IN THE MEDICAL AND NATURAL SCIENCES

IN the medical sciences The Rockefeller Foundation, during 1933, appropriated $1,173,853. In aid of programs of specific concentration in the fields of psychiatry and public-health teaching appropriations were made to the Johns Hopkins University School of Medicine for research in psychiatry; to University College, London, for work in biophysics and neurophysiology; to Washington University, St. Louis, Missouri, for investigations in nerve physiology, and to the Harvard Medical School and Massachusetts General Hospital for cooperative work in psychiatry. For the development of teaching in

public health and preventive medicine an appropriation was made to Dalhousie University, Halifax, Nova Scotia. During 1933 the foundation provided 295 fellowships in the medical sciences. In addition, research aid grants in sums varying from $55 to $3,000 enabled sixty-one investigators and groups to carry on research work.

Foundation appropriations in the natural sciences amounted to $807,250. For specific programs of research in the vital processes, particularly in biology and psychology, and in the field of the so-called earth sciences, contributions were made to a number of institutions, among them the California Institute of Technology for research in biology and chemistry; the University of Chicago for biological research; the National Research Council for research in problems of sex and the effects of radiation on living organisms; the Roscoe B. Jackson Memorial Laboratory in Bar Harbor, Maine, for research in mammalian genetics, and the Massachusetts Institute of Technology for aerological research. In addition to the more important grants, awards comparatively small in amount were made for the purpose of exploring new fields of study and increasing opportunities for work which has been retarded because of the present economic situation.

The total number of fellowships in the natural sciences administered by the Rockefeller Foundation during 1933 was eighty-nine. In addition, eighty-eight individuals received new appointments for fellowships administered by the National Research Council with funds supplied by the foundation.

SCIENTIFIC NOTES AND NEWS

DR. AMBROSE SWASEY, of Cleveland, was guest of honor at a dinner given in New York City on the occasion of the celebration of the twentieth anniversary of the Engineering Foundation. Dr. Swasey, who will be eighty-eight years old on December 19, established the foundation in 1914 and has contributed $750,000 to its endowment. Dr. Karl T. Compton, president of the Massachusetts Institute of Technology, and Dr. Frank B. Jewett, president of the Bell Telephone Laboratories and vice-president of the American Telephone and Telegraph Company, were the principal speakers. Harry P. Charlesworth, chairman of the foundation, presented to Mr. Swasey a volume containing expressions of felicitation and gratitude on behalf of the various organizations comprising the Engineering Foundation.

DR. EDWIN O. JORDAN, until his retirement in 1933, after forty-one years' service to the university, chairman of the department of hygiene and bacteriology of the University of Chicago, was awarded the Sedgwick Memorial Medal for distinguished service in public health at the Pasadena meeting of the American Public Health Association. Dr. Jordan still offers graduate courses at the university.

COLLEAGUES of Dr. Edward R. Baldwin, director of the Edward L. Trudeau Foundation, Saranac Lake, marked his seventieth birthday on September 8, by presenting him with an armchair. Dr. James Woods Price made the presentation speech at a gathering at Dr. Baldwin's home in the evening, attended by about twenty-five physicians.

DR. DONALD CHURCH BALFOUR, of the Mayo Clinic, Rochester, Minn., was elected president of the American College of Surgeons for 1935–36 at the recent meeting in Boston to succeed Dr. Robert B. Greenough, of Boston. The two vice-presidents chosen were Dr. Arthur W. Allen, of Boston, and Dr. John A. Gunn, of Winnipeg. Members of the Board of Regents to serve during the term expiring in 1937 are: Dr. Samuel C. Harvey, of New Haven, Conn.; Dr. Allen B. Kanavel, Chicago; Dr. Charles H. Mayo, Rochester, Minn.; Dr. Alexander R. Munroe, Edmonton, Alberta, Canada, and Dr. J. Bentley Squier, of New York City. Surgeons receiving honorary fellowships were: Sir Harold Gillies, of London, plastic surgeon at St. Bartholomew's Hospital; Dr. Josef Halban, professor of gynecology at the University of Vienna; Harry Platt, lecturer in orthopedic surgery at the University of Manchester, and Dr. Bethel Solomons, of Dublin, examiner in obstetrics and gynecology at the Royal College of Physicians and Surgeons of Ireland.

DR. HERMANN VON SCHRENK, St. Louis, Mo., consulting timber engineer of the New York Central Lines and senior vice-president of the American Society for Testing Materials, was elected president of the society on October 9, to fill the vacancy caused by the death on July 21 of W. H. Bassett soon after he took office as head of the society. The vacancy caused by Dr. von Schrenk's election was filled by the election of H. S. Vassar as senior vice-president. A. C. Fieldner, chief engineer of the Experiment Stations Division, U. S. Bureau of Mines, was elected junior vice-president.

B. F. SHEPHEARD, manager of the rock drill department of Ingersoll-Rand Company, was elected president of the American Society of Metals at the recent annual meeting of the society in New York City.

DR. C. E. KENNETH MEES, director of the Eastman Kodak Company, has been elected a vice-president of the company.

AT the annual meeting of the Virginia Chapter of Sigma Xi, the following officers were elected: Dr. J. W. Beams, professor of physics at the University of Virginia, *president;* Professor Walter S. Rodman, professor of electrical engineering, *vice-president,* and Dr. Edwin M. Betts, *secretary-treasurer.*

OFFICERS of the Indiana Chapter of the Society of Sigma Xi for the coming year are: *President,* P. M. Harmon, physiology; *Vice-president,* C. E. May, chemistry; *Secretary,* C. M. Louttit, psychology; *Treasurer,* W. D. Thornbury, geology. At the same meeting the retiring president, Dr. Paul Weatherwax, gave an illustrated paper on "Indian Corn in Ancient America."

SIR JOHN CADMAN and Sir James Jeans have become members of the Advisory Council to the Committee on Scientific and Industrial Research of the British Privy Council.

The British Medical Journal reports that Professor Bruno Oskar Pribram, director of St. Hildegard's Hospital of Berlin, has been made a corresponding member of the Société Nationale de Chirurgie of Paris; Dr. Ludwig Robert Müller, professor of internal medicine at Erlangen, honorary member of the Neurological Society of Tokyo, and Dr. Ludwig Frankel, professor of obstetrics and gynecology at Breslau, honorary member of the Italian and Brazilian Societies of Gynecology and Obstetrics.

THE Board of Regents of the University of Michigan has established a Jonathan Taft professorship in dentistry for Dr. Marcus L. Ward, who retired as dean of the school of dentistry in August. The professorship takes its name from that of the first dean of the school and it was given to Dr. Ward to enable him to devote his time to teaching and special research.

DR. HOKE S. GREENE, development and production chemist of the E. I. du Pont de Nemours and Company, of Niagara Falls, N. Y., has been appointed to an assistant professorship of chemical engineering at the University of Cincinnati.

DR. PHILIP HILLKOWITZ, of the Ohio Medical College, has been appointed associate professor of chemistry at the University of Denver, and will have charge of a newly established course in medical technology.

DR. PETER MÜHLENS, professor of tropical diseases at Hamburg, has been appointed director of the Hamburg Institute for Tropical Diseases, in which he had been serving as department director. Dr. Erwin Jacobsthal, docent in the university, has been called to the University of Guatemala as professor and director of the Institute of Bacteriology.

A. S. ARGUELLES, assistant director of the Philippine Bureau of Science, has been appointed director to succeed Dr. William H. Brown, retired. Mr. Arguelles is the first Filipino director of the Bureau of Science since its foundation in 1901. Dr. Leopoldo A. Faustino, chief of the Division of Mines, has been appointed assistant director.

DR. J. M. AIKMAN, associate professor of botany at the Iowa State College, has been given leave of absence to become senior botanist in the shelter belt project of the U. S. Department of Agriculture.

DR. J. G. WOODROOF, formerly horticulturist at the Georgia Experiment Station at Griffin, has become horticulturist for the Federal Emergency Relief Administration for the southern states. Besides directing a general horticultural program for rural rehabiiitation families in this area, he is in charge of a project of planting 5,000 acres of improved varieties of muscadine grapes.

ACCORDING to *Industrial and Engineering Chemistry,* Thos. R. Cunningham, chief chemist of the Union Carbide and Carbon Research Laboratories, Inc., at Long Island City, N. Y., has been transferred to Niagara Falls, N. Y., where the corporation has recently completed the erection of a modern research laboratory.

LEE R. DICE, of the Museum of Zoology of the University of Michigan, has been made acting director of the Cranbrook Institute of Science, Bloomfield Hills, Mich., to succeed Victor H. Cahalane, who has resigned to enter the National Park Service. Harold J. Leraas has been appointed to replace Donald T. Ries in charge of vertebrate zoology.

DR. MADISON BENTLEY, Sage professor of psychology at Cornell University, has leave of absence. He plans to spend the first term at Santa Fé, N. M., where he will continue his work in Indian research under the Carnegie Foundation.

DR. M. J. BONN, lecturer on folk lore at Berlin, will be visiting professor at the University of California in Berkeley for the second semester. He is expected to arrive in New York on December 22.

PROFESSOR BRONISLAW MALINOWSKI, professor of anthropology at the University of London, who has spent the past three months in research work in Africa, plans to spend six weeks in the United States in the spring.

DR. JAMES P. LEAKE, senior surgeon, U. S. Public Health Service, Washington, D. C., gave an illustrated lecture before a joint meeting of the Institute of Medicine of Chicago and the Chicago Society of Internal Medicine at the Chicago Woman's Club on October 26. His subject was "Poliomyelitis, with Special Reference to Epidemiology." Dr. Leake has been in

California for several months studying the epidemic there.

DR. MAURICE N. RICHTER, of the College of Physicians and Surgeons, Columbia University, addressed the Pathological Society of Philadelphia on October 11 on "Experimental Aspects of Leukemia."

THE Founders' Day address at the School of Medicine of Northwestern University was made by Dr. Leslie B. Arey, Robert L. Rea professor of anatomy, on "Old Ideals in Modern Medicine."

PROFESSOR EDWARD KASNER, of Columbia University, is giving six lectures on "Specimens of Higher Mathematics" at the New School for Social Research, New York City.

THE council of the American Association for the Advancement of Science has appropriated $3,000 for grants in aid of research. It is the policy of the association to make the grants of small amount and its preference to give them to research workers in smaller and less well-known institutions. Professor Arthur H. Compton, chairman of the committee on grants, is at present in Europe and applications should be addressed to the permanent secretary of the American Association for the Advancement of Science, Smithsonian Institution Building, Washington, D. C.

THE 194th regular meeting of the American Physical Society will be held at Washington University, St. Louis, on Friday and Saturday, November 30 and December 1. This meeting will celebrate the opening of the new laboratories of physics. On Saturday morning there will be a special symposium on x-ray scattering with papers by G. E. M. Jauncey, G. W. Stewart, E. O. Wollan and W. H. Zachariasen. In addition there will be programs of contributed papers. The following meeting will be held on December 21 and 22 at Los Angeles, Calif., and the annual meeting will be held on December 27, 28 and 29 at Pittsburgh, Pa., in conjunction with the meeting of the American Association for the Advancement of Science.

ON October 13, the San Diego Society of Natural History celebrated with open house at its museum in Balboa Park, San Diego, the sixtieth anniversary of its founding. The society was incorporated on October 9, 1874, and is the oldest scientific institution in southern California. With the single exception of the California Academy of Sciences in San Francisco, it is older than any scientific institution west of the Rockies.

APPLICATIONS for the position of metallurgist in the Ordnance Bureau, War Department, with headquarters at Rock Island, Ill., must be on file with the U. S. Civil Service Commission at Washington, D. C., not later than November 8. The entrance salary is $3,800 a year, subject to the usual deductions. Applicants must show that subsequent to college graduation they have had at least five years of progressive professional experience in important and responsible physical metallurgical work which must have included the supervision of and responsibility for the work of others. Postgraduate work in physical metallurgy successfully completed in a college or university of recognized standing may be substituted year for year for the prescribed experience up to a maximum of three years.

APPLICATIONS for the positions of agent for home economics and special agent for home economics education (special groups), Office of Education, Department of the Interior, must be on file with the U. S. Civil Service Commission at Washington, D. C., not later than November 19, 1934. The entrance salary for agent for home economics is $4,600 a year, and for special agent for home economics education (special groups) $3,800 a year, subject to the usual deductions. Competitors will not be required to report for a written examination, but will be rated on their education and experience and on a thesis or published writings.

ACCORDING to an Associated Press dispatch, after a ten-year search for a desirable site, an observatory to house the large telescope with the 200-inch mirror will be erected, if terms can be arranged, on Palomar Mountain, eighty miles northeast of San Diego. Representatives of the California Institute of Technology met on September 22 with William Beech on the Beech ranch on Palomar Mountain to make final arrangements to acquire the site for the observatory. Palomar Mountain is the only peak in the vicinity which does not border the desert country on the east or lie too close to the ocean on the west, which is said to give it the atmospheric conditions regarded by astronomers as particularly favorable.

AN anonymous donor has given $400,000 to construct the building for a new Laboratory of Chemistry at Trinity College, Hartford, Conn. The alumni now seek to raise by December 1 $100,000 for equipment and $200,000 as an endowment to provide for operating expenses. Plans for the building are being prepared by McKim, Mead and White, architects of New York, who with Dr. Vernon K. Krieble, Scoville professor of chemistry, have recently completed a study of chemical laboratories in other colleges.

THE Biological Station at Hamilton, Bermuda, has converted a former power station into a library to house the 6,000 volumes given by Dr. E. L. Mark, of Harvard University, formerly director of the station. Funds to make the building fireproof were given by Mrs. Charles Griffith, of Ardmore, Pa.

THE Institute of Medicine of Chicago again offers the Joseph A. Capps Prize of $500 for the most meritorious investigation in medicine or in the specialities of medicine, or in the fundamental sciences provided the work has a definite bearing on some medical problem. Competition is open to graduates of Chicago medical schools who have received the degree of M.D. during the year 1932 or thereafter, and manuscripts must be submitted to the secretary of the institute, 122 South Michigan Boulevard, Chicago, not later than December 31, 1934. If no paper presented is deemed worthy of the prize, the award may be withheld at the discretion of the Board of Governors.

UNDER the will of Mrs. Mary Jane Williams, widow of Dr. Charles Theodore Williams, honorary fellow of Pembroke College, Oxford, £30,000 is left to the University of Oxford, to be expended in the promotion of medicine; £5,000 to the Royal College of Physicians, and a large residue to Pembroke College.

DISCUSSION

REFORM IN THE SYSTEM OF SCIENTIFIC PUBLICATION

THE following proposal, submitted to the sixteenth International Geological Congress in its session in Washington on Friday, July 28, 1933, and approved by the congress, may be of interest in connection with the articles of Dr. Seidell and Dr. Visscher in SCIENCE for July 20, 1934, page 70, and September 14, 1934, pages 245–246, respectively.

A PROPOSAL OF THE ASSOCIATION OF SCIENTIFIC INSTITUTIONS OF THE MINING INDUSTRY IN THE U. S. S. R. TO THE INTERNATIONAL GEOLOGICAL CONGRESS, XVI SESSION, IN WASHINGTON, U. S. A.

The growth of special scientific literature, published chiefly by numerous scientific institutions, is increasing with marked rapidity. It becomes more and more difficult to follow up this special literature, and it wastes a great deal of the time of investigators. In consequence of this, special periodicals are issued exclusively for the purpose of reviewing and summarizing these scattered publications. In other periodicals again much space is taken up in reviewing articles. Some small papers are reviewed several times over, and altogether more time and money is spent on the publishing of the reviews than on these papers themselves. A means of diminishing as far as possible this nonproductive work and of making scientific literature accessible to every person of moderate means, living far from great centers with large libraries, is available:

1. By dividing up even the most specialized periodicals, geological, mineralogical, etc., into "separates."

2. By centralizing and systematizing these "separates" in central bibliographical institutes for every subdivision of science in every country.

At the beginning some subdivisions of science may be centralized especially in countries where a small number of scientific papers is published. In these institutions a subscription is to be organized not for periodicals, but according to subjects.

It is proposed that every scientific paper should be published as a separate, preserving on it the numbering of the pages of the periodical. Many scientific institutions practice this mode of publishing. The scientific institutions of the U. S. A. in particular have in this way greatly contributed to the progress of scientific research.

The publishing of separates is helpful not only to scientists but to the smaller libraries as well. Such separates would enable the libraries to avoid unnecessary duplication. It is useful, on the other hand, to issue these publications in complete and uniformly bound volumes. It follows, therefore, that to save the money both of the publishers and of the readers, the methods of publication used by the institutions should be regulated as follows:

1. Scientific institutions for the purpose of exchange with other institutions and for distributing their publications among large libraries should as far as possible issue their publications in complete bound volumes.

2. Scientific institutions for the purpose of circulating the results of the research of their members as widely and as rapidly as possible should issue each publication in separates and at as low a price as possible, which should be printed on the back of the cover.

For the complete success of this project, it is necessary that private persons publishing special scientific periodicals should introduce a twofold method of publication—as separates and in complete volumes. The profit the publisher obtains from the sale of separates will certainly compensate the fall in the number of annual subscribers.

All the aforesaid concerns only those periodicals that publish larger articles; short notices and articles (of one or two pages) which are not suitable for printing as "separates" should be published according to the subject they treat (geology, mineralogy, petrology, etc.) in special periodicals (*The American Mineralogist*, *Centralblatt für Geologie*, etc.).

To make the work of assistants in the central institutes entirely mechanical it will be necessary to print on the cover of the separates the symbols (letters or ciphers) assigned by the International Catalog of Scientific Literature to the given branch of science.

For example; on the cover of the separate: Serra, Aurelio, Su un notevole granato di Fluminimaggiore. Napoli, Rend, Acc. Sc. (ser. 3) 16, 1910 (222–224):

In the left-hand upper corner should be printed 60 dh; 60 = Geographical distribution, dh = Italy. In the right-hand upper corner should be printed 50; 50 = Descriptive mineralogy.

As it is difficult to judge from the title what signifi-

cance the author attaches to his paper, it is necessary to put the subject symbol in brackets when the investigator emphasizes the local interest of his paper and *vice versa.*

The Association of Scientific Institutions of the Mining Industry in the U. S. S. R. addresses the council of the congress with the following proposal:

Will the council of the congress find it possible to apply through its members or otherwise, to those scientific institutes which do not yet print separates for sale, with the request that they publish mineralogical, geological, petrological, and paleontological papers not solely in the periodicals published by them, but also as separates?

Will the council of the congress find it possible to apply through its members, or otherwise, to these mineralogical, geological, paleontological, and mining institutions with the proposal to organize such institutions for propagating and distributing scientific literature on geology, mineralogy, petrology, and related branches of science?

The association, for its part, will do its best to forward the carrying out of this proposal in the U. S. S. R.

(Signed)

President, PROF. N. FEDOROVSKY
Secretary, T. SALKIND

In the discussion it was pointed out that publishers, who are always willing to issue a given number of separates on request, might find it an expensive proposition to publish regularly separates of each paper, even though there might be little demand for many of them. In reply, it was suggested that it might be possible for publishers to maintain a subscription list for separates just as for the entire series.

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THE MECHANISM OF THE ANTIDOTAL ACTION OF METHYLENE BLUE IN CYANIDE POISONING

BROOKS[1] has recently published results of experiments which she believes prove conclusively that methylene blue does not act as antidote for cyanide in animals by converting hemoglobin to methemoglobin (known to combine rapidly and firmly with cyanide), as was suggested by Hug[2] and the writer.[3] Rather, Brooks contends that the dye antagonizes cyanide poisoning by acting in the tissues as a reversible oxidation-reduction system. Brooks bases this conclusion upon her failure to detect methemoglobin in the blood of animals following administration of the dye.

The papers and conclusion of Brooks are subject to criticism on two accounts. *First:* Brooks states that the system blood-methylene blue *in vitro* (the behavior of which originally suggested to the writer that methemoglobin formation might account for the dye's action *in vivo*) differs markedly as regards glucose concentration from the same system *in vivo*. *In vitro,* she says, the glucose is "quickly used up" and "methemoglobin heaps up." It should be pointed out that methylene blue does not remain in the blood in significant quantities longer than thirty minutes after intravenous injection, and that in so short a period normal blood does not show a greatly reduced glucose concentration when incubated *in vitro* (at 37°) with methylene blue. In fact, the rate of disappearance of glucose from blood thus incubated is only slightly greater than that due to glycolysis alone. Since space limitations prohibit complete discussion of the several factors involved the reader is referred to the papers of Barron and Harrop, Warburg and coworkers and the writer[4] for clarification.

There is a striking difference between the system *in vivo* and *in vitro;* it concerns, however, methylene blue concentration. This difference is determined by the rapid disappearance of the dye from the blood following injection. Fifteen to twenty minutes after intravenous injection of 15 mg of methylene blue per kilo into dogs extremely little of the dye remains in the blood; it has gone into the tissues. This fact accounts for failure of methemoglobin to accumulate in detectable quantities.

Second: Brooks does not deny the formation of methemoglobin by the action of methylene blue on blood *in vivo.* She denies its accumulation. She states that *in vivo* methemoglobin is reduced as fast as it is formed. The writer's experiments are in agreement with this statement. No methemoglobin (less than 3 or 4 per cent. of the total pigment) accumulates when the dye alone is administered in clinically recommended quantities. Brooks, however, fails to consider the difference between the behavior of the system blood-methylene blue and the same system plus cyanide. Cyanide, by combining with methemoglobin as it is formed, effectively blocks its reconversion to hemoglobin by leuco-methylene blue (Warburg and Reid) and by the enzyme systems in the red blood cells (Wendel), and thus causes methemoglobin to accumulate (as cyanmethemoglobin). This is readily demonstrable *in vitro.* Furthermore, the writer finds, on the average, something over one half of 2 M.L.D's. (6 mg of HCN per kilo) of subcutaneously administered cyanide bound as cyanmethemoglobin in the circulating erythrocytes of dogs saved from such quan-

[1] M. M. Brooks, *Proc. Soc. Exp. Biol. Med.,* 31: 1134, 1934; and SCIENCE, 80: 15, 1934.
[2] E. Hug, *Compt. rend. Soc. biol.,* 112: 511, 1933.
[3] W. B. Wendel, *Jour. Amer. Med. Assoc.,* 100: 1054, 1933.
[4] For references of the large number of papers by Barron and coworkers and Warburg and coworkers, the reader is directed to the bibliographies in the writer's papers: *Jour. Biol. Chem.,* 102: 373 and 385, 1933.

tities of the poison by methylene blue. Since it seems probable that a not inconsiderable fraction of administered cyanide is also bound by tissue methemoglobin and since the animals, in spite of administration of large quantities of the dye, show a considerable degree of cyanide poisoning, it appears probable that the binding of cyanide by methemoglobin accounts for the greater part of the dye's action.

Details of the writer's experiments will be published elsewhere.

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TWO RATTLESNAKES KILLED BY A COTTONMOUTH

AT least three recent papers[1] have commented upon the susceptibility of certain North American Crotalid snakes to the venoms of their own or related species. In these it is shown that the widely circulated statement that poisonous snakes are immune to their own and each other's venoms is not infallibly true; cases are cited in which specimens bitten or injected with venom died with marked symptoms of snake bite poisoning. Two additional fatal cases have recently been noted in the collection of the Toledo Zoological Park.

Two Pacific rattlesnakes, *Crotalus confluentus oreganus* (Holbrook), were placed temporarily in a cage containing several cottonmouth moccasins, *Agkistrodon piscivorus* (Lacépède). At 8:00 A. M. on June 7, 1934, one of the moccasins was found grasping a rattler in its jaws and with its fangs apparently imbedded two or three inches anterior to the base of the tail. When the snakes were separated the rattlesnake crawled slowly away, dragging its tail as if the latter were paralyzed. When viewed from a little distance neither swelling nor fang marks were evident. Three hours later the area which had been held by the moccasin was considerably swollen and gradually increased in size until the snake died at 1:15 P. M. An autopsy showed a marked edema, extending three or four inches forward from the anus. The muscular tissue was soft and purplish red and the skin was beginning to slough away from the body. The left kidney was swollen and deep purple in color. The rattlesnake measured twenty-six inches in length; the moccasin about thirty.

Four days later the same moccasin was discovered swallowing the second rattlesnake head first. When the cottonmouth had been forced to disgorge, the victim showed marked distress and moved with considerable difficulty. Two hours later it seemed dead, but feeble movements were noted until a short time before the snake died about nine and a quarter hours after the first observation. Its head and about four inches of the neck were swollen enormously and resembled a snake in the act of swallowing a sizable object. There was a marked edema and a deep purplish coloration in this area, the tissue surrounding the right fang being most intensely affected. This rattlesnake measured twenty-nine and five-eighths inches in length.

While the actual bites were not observed in either case, the symptoms, typical of snake poisoning, indicated that each rattlesnake received an appreciable amount of venom. The same moccasin also killed and ate a smaller snake of its own species, but the incident was not noted in time to permit detailed observations.

ROGER CONANT

TOLEDO ZOOLOGICAL SOCIETY
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[1] Gloyd, SCIENCE, 78: 2010; Wooster, SCIENCE, 78: 2030, and Nichol, Douglas and Peck, *Copeia* 4, 1933.

DIARIES OF EARLIER GENERATIONS IN THE STUDY OF SLEEP

MANY clinicians and other competent observers have called attention to the changed pace of life which they believe may be a factor in causing that vague condition peculiar to civilization and which is sometimes called "Americanitis." Whether or not a wide-spread curtailment of the amount of sleep exists may throw light on one of the possible causes, both direct and indirect, of this observed condition. We are trying, from a study of diaries, to discover if the hours of sleep to-day are in fact significantly shorter than those of our fathers and grandfathers.

The diaries which are available to the workers in the laboratory are, unfortunately, not numerous. Hence an appeal to the readers of SCIENCE to scan any diaries from twenty-five to seventy-five years old which may be in their possession in order that we may have an adequate sample of records for study.

The data which a diary reveals, and which we should appreciate having forwarded to us, are: (1) Hour of retiring, (2) hour of rising, (3) the date of the original entries, (4) residence at the time of the entries, and (5) age of the diarist at the time of the entries.

We have secured several diaries which record these data intermittently over a life span; in such instances we are abstracting a sample of hours of retiring and of rising in the early twenties, in the early forties and again in the early sixties of the individual's life. We should esteem the cooperation of any readers who would abstract such data from diaries they have, including the sex and name of the diarist with the other data.

DONALD A. LAIRD

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A KYMOGRAPH TIME-INTERVAL RECORDER

A KYMOGRAPH time-interval recorder is a valuable but not always available asset to any physiology laboratory. It is possible, however, to construct such an instrument at almost no cost. The device which we will describe possesses the decided advantage of recording one-half second intervals.

All extraneous parts such as case, face and alarm mechanism are removed from an ordinary alarm clock. It is not entirely necessary to remove this last. The mechanism is mounted by its frame to a wooden base with the balance and escape mechanisms at one end of the frame of the clockwork and not at the top or bottom.

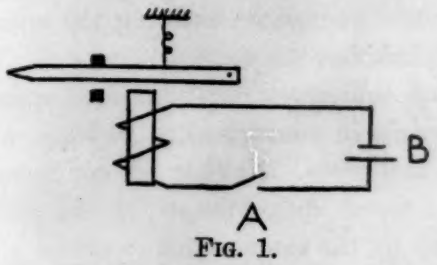

FIG. 1.

A brass wire about 0.2 mm in diameter is manipulated in the following manner: Wind it in from 3 to 5 coils, each having a diameter of about 5 mm, leaving 2 cm at one end and 10 cm at the other; bend the short end along the axis of the coil for 1 cm and the rest at right angles to this; bend the long end at right angles to both the coil and the last length of the short end. The arrangement of this wire is shown diagrammatically in Fig. 2.

Next, fasten the long end of the brass wire by means of a screw driven into the wooden base so that the straight part of the long end rises vertically and the last length of the short end just escapes the cogs of the escape wheel and is parallel to its axle in a horizontal plane. See Fig. 2.

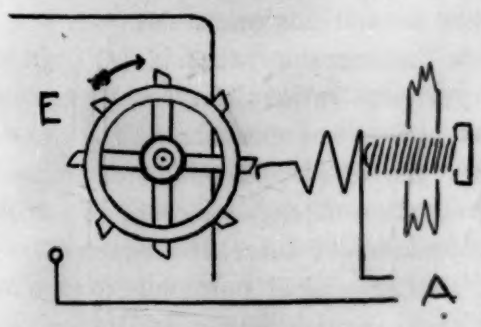

FIG. 2.

Mount a wooden panel to the base in such a manner that it rises vertically, is parallel to the axle of the escape wheel, and lies 1 cm from the coils of the brass wire. Drive a bolt through a close-fitting hole in the panel along the axis of the brass coil.

Wire the apparatus according to Fig. 2. (A) represents two terminals of the clockwork. One of these is taken from the brass wire where it is fastened to the base; the other is taken from the frame of the clock. These two terminals are wired in series with a signal magnet and a battery of sufficient electromotive force to operate the magnet (Fig. 1).

Now, if the bolt through the panel is used to spring the coil of the brass wire close enough to the escape wheel (E, Fig. 2) so that a light contact is made with each cog as it passes, a circuit will be closed regularly, causing the stylus of the signal magnet to make a stroke each time. Also, if the alarm clock used is constructed as most alarm clocks are, this circuit will be closed each one-half second.

Other panels can be used to enclose the clockwork in a box leaving one side hinged for winding. The terminals of this unit of the circuit can be wired to posts through a panel.

It will probably be necessary to calibrate the instrument by adjusting the hair spring.

The apparatus may be placed in some inconspicuous place and any number of signal magnets wired from it to remote parts of the laboratory.

Except for a periodic winding, this instrument requires no care and should record accurately for ordinary purposes.

GEORGE POUCHER, JR.
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A MECHANISM FOR THE CONTINUOUS CIRCULATION AND AERATION OF WATER IN SMALL AQUARIA[1]

IN biological experimentation with aquatic organisms it is frequently necessary to keep the water agitated and aerated for considerable periods of time. Generally air is bubbled into the water while a stirring motor functions. This method is often unsatisfactory when the experiment is to continue for some time, for oil vapor is liable to enter the water with the air current; also, the stirrer tends to create strong currents which may interfere with the experiments. The mechanism here described eliminates these difficulties. It has been used by the author during two years with entire satisfaction. It may be kept in operation for weeks or months with little attention.

The aerating and circulating device consists of a small, motor-driven, centrifugal pump made of transparent celluloid $\frac{1}{8}$ inch thick (Fig. 1). The pump is similar in design to ordinary pumps of this type save that it is enclosed within a chamber from which it

[1] Published by permission of the Commissioner of Fisheries.

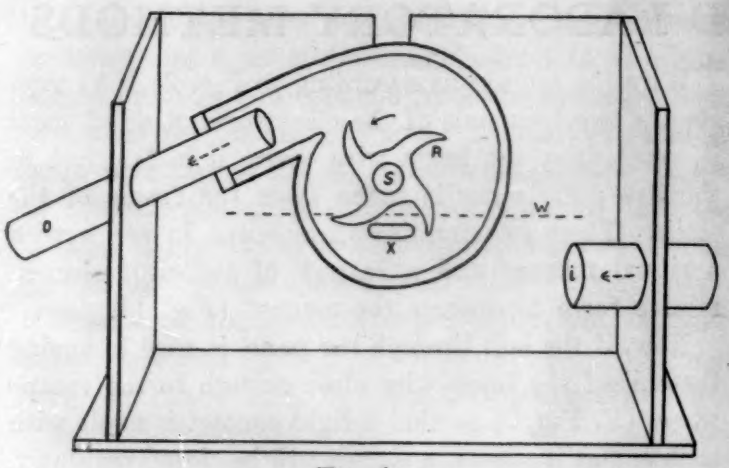

FIG. 1.

draws water. In the figure one side of the chamber and of the pump have been removed to show details. The pump is made with two sides (vertical diameter 1½ to 2 inches), and the peripheral border, slightly greater than ⅛ inch wide, which is bent in warm water to correct shape and cemented in place with a solution of celluloid in acetone. The rotor (R) is cut from a piece of ⅛ inch celluloid and mounted on the shaft of ¼ inch glass tubing with a short length of rubber tubing in between. The openings for the shaft in the sides are considerably larger than the shaft to eliminate friction. The completed pump is simply cemented into the chamber in which slots are left for the two ends of the shaft. The slots extend downward only far enough to leave the shaft clear. In action the pump receives water through the hole (X) in each side and pumps it out through the tube (o) leading directly into the experimental aquarium. A larger tube (i) leads from the aquarium into the pump chamber to permit continuous replenishment of the water. It was generally arranged so that the pump discharged water to the bottom of the experiment tank.

It is only necessary to keep the water level relatively constant so that the pump does not run dry. The pump is so placed with reference to the experiment tank that when not running the water level (W) is slightly above the intake apertures (X). When running the pump discharges water as rapidly as it enters through the apertures, reducing the water level so that both air and water are drawn into the pump. Here the water is violently churned with air by the rotor and the water entering the aquarium is full of small bubbles.

The pump is entirely water-lubricated and the only foreign materials in contact with the water are celluloid, rubber and glass. Neither oil nor metallic ions can enter. Several such pumps may be mounted in series and run by the same motor to aerate and circulate the water in a number of aquaria. Due to the loose bearings there is no indication of wear even after months of almost continuous running.

A. E. HOPKINS

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SPECIAL ARTICLES

ACTION OF DINITRO COMPOUNDS ON SEA URCHIN EGGS[1]

A STUDY of the effect exerted by 4–6 dinitro-o-cresol (DNC) on the eggs of the sea urchin (*Arbacia Punctulata*) shows that this reagent, at 21° C., in optimum concentrations, stimulates oxygen consumption four hundred per cent. in fertilized and six hundred per cent. in unfertilized eggs, and that it simultaneously suppresses cell division in the fertilized eggs. Potassium cyanide antagonizes the respiratory stimulating action, but supplements the division suppressing action of DNC.

The DNC block to division in fertilized eggs is completely reversible even after three hours exposure to a concentration seven to ten times the optimum for respiration. The eggs, on being returned to sea water, continue cell division from the point of interruption and develop to swimming larvae. That these effects are attributable to the nitro substituted molecule is indicated by the fact that phenol and o-cresol block cell division only in concentrations several thousand times as great as those required for the corresponding dinitro compounds.

The data indicate that the optimum respiratory concentration of DNC is also the concentration which first significantly suppresses cell division. Similar experiments with thirteen other cell penetrating nitro compounds and with the eggs of other invertebrates have shown that the optimum concentrations for respiration are invariably critical concentrations for division. The ability of dinitro compounds to affect respiration and division becomes less as their ability to penetrate the cell decreases.

The data further show that if DNC in optimum respiratory concentration is added more than 20 to 25 minutes before first cleavage is due to occur relatively few eggs divide; if added after this time a normal proportion of eggs proceeds to the two-celled stage, where most of them are arrested in development. A similar critical point has been observed at about the same relative time prior to the second and third cleavages.

A preliminary cytological examination, made by Dr. Henry J. Fry, seems to have established two points regarding eggs in which division has been suppressed by DNC.

(1) Nuclear division does not continue after cytoplasmic division has ceased.

[1] Preliminary note.

(2) About sixty-six per cent. of the eggs are in early prophase (two new asters have arisen; chromosomes are becoming organized; and the nuclear membrane is still intact). In normal, untreated, control eggs, under comparable conditions, only about twenty-five per cent. are in prophase.

There is also some evidence that in these DNC treated eggs, darkly staining chromatin may be recognized somewhat earlier than in normal eggs, that is during the late resting phase instead of early prophase.

These experiments, as well as others on unfertilized eggs and the fertilization process, indicate that so far as suppression of division is concerned, DNC acts on the nucleus rather than on the cytoplasm or plasma membrane, and that this effect may be due to some modification of or interference with an oxidative process occurring in the late resting phase or early prophase. Further experiments are being conducted to determine the mode of action of the dinitrophenols and their reduction products.

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POSITIVE INFECTION TRIALS WITH ELM "WILT" FUNGI

FOLLOWING the isolation of a variety of fungi from diseased American elms in Illinois, as reported by Harris[1] in 1932, a considerable series of inoculation tests has been carried out and success in reproducing infection has been obtained with 3 of the fungi considered by Harris as most important, namely, two strains of Coniothyrium, designated as "A" and "B," and Phoma "B." It now appears advisable to announce the results of some of these tests.

Each of four three-year-old elm seedlings were inoculated with Coniothyrium "A" in the laboratory on April 6, 1934. A sliver of elm wood, previously sterilized and then well inoculated with a pure culture of the fungus, was inserted through a T-shaped slit in the bark so as to lie in contact with the xylem of the seedling. A glass tube, containing moist cotton at the base, was fitted on the inoculated branch and held in place by perforated corks, in order to surround the inoculation with a moist atmosphere, and the cotton was kept moist during the first few weeks. Pycnidia of the Coniothyrium soon formed on the exposed xylem in the T-shaped slits of all four of the seedlings as well as on the wood slivers used as carriers of inoculum. By the middle of July the inoculated lateral branch of one seedling had shown a slowly progressing but definite "wilt" and, three weeks later, was dead from the tip down to 9 cm below the point of inoculation. Cultural platings from this seedling yielded the Coniothyrium "A," with which it had been inoculated, as far as 20 cm below the point of inoculation and 11 cm below any external evidence of infection.

In another test a positive result was obtained with Coniothyrium "B." Two three-year-old seedlings were inoculated on January 4, 1934, in the following manner. The bark was scraped off one side of the stem for a vertical distance of 1 cm, exposing the xylem. Corn-meal agar containing actively growing mycelium of the fungus was placed in contact with the xylem and covered by a layer of moist cotton. This was enclosed by Cellophane held in place by adhesive plaster. Of these seedlings, one showed symptoms of a general infection by the end of March, and cultural isolations were made from it on April 10. Coniothyrium "B" was obtained from points as far as 15 cm above and 12 cm below the point of inoculation.

Phoma "B," the third agent used, was found to be capable of infecting elm leaves within a very short time. Drops of a spore suspension were placed upon living, detached leaves suspended in a petri dish with the open end of the petiole immersed in water, in modification of the method described by Clinton and McCormick.[2] Development of mature pycnidia took place in the mesophyll within five days. A more abundant infection took place when spores were planted on the upper leaf surface, in spite of the fact that stomates are much more numerous on the lower surface. While these experiments with the Phoma do not furnish conclusive proof of the ability of that fungus to infect a healthy elm tree, they suggest the means by which it gains entrance to the trees from which it is isolated in culture.

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AN ANTIRACHITIC DERIVATIVE OF CHOLESTEROL[1]

RECENTLY Koch, Koch and Ragins[2] reported that provitamin D is not limited to ergosterol but can be formed from cholesterol. In this laboratory an antirachitic substance produced from cholesterol but different from vitamin D has now been isolated in pure form and known constitution through an investigation of the chemistry of the Bills[3] method for the

[1] Hubert A. Harris, "Initial Studies of American Elm Diseases in Illinois," *Ill. St. Nat. Hist. Surv. Bull.* 20(1): 1–70, 1932.

[2] G. P. Clinton and Florence A. McCormick, "Rust Infection of Leaves in Petri Dishes," *Conn. Agr. Exp. Sta. Bull.* 260: 475–501, 1924.

[1] Journal paper No. J182 of the Iowa Agricultural Experiment Station, Ames, Iowa. Project No. 103.

[2] F. C. Koch, E. M. Koch and I. K. Ragins, *Jour. Biol. Chem.*, 85: 141, 1929.

[3] C. E. Bills, *Jour. Biol. Chem.*, 67: 753, 1926; C. E.

antirachitic activation of cholesterol with fuller's earth. Bills,[3] and Kon, Daniels and Steenbock[4] concluded several years ago that this active substance was different from vitamin D. However, in working with purer preparations we found that the effect on intestinal reaction, iron reduction and even bone calcification[5] was similar to that of irradiated ergosterol products.

Data with experimental procedures to be reported elsewhere have led to the clarification of the chemistry of the fuller's earth activation of cholesterol. The cholesterol activating constituent of the reactive earth was found to be sulfuric acid or its anhydride. The initial reaction was a dehydration of the cholesterol not only to the dicholesteryl ether, as Bills found, but to the ultimate dehydration product, cholesterilene, of Mauthner and Suida.[6] The final reaction then was found to be sulfonation at the site of the double bond created by the removal of a molecule of water. Actually the concentration of the antirachitic substance was much increased by the treatment of the cholesterilene in carbon tetrachloride with a small amount of sulfur trioxide. This is a well-known method for the sulfonation of aromatic hydrocarbons. Still better yields of the antirachitic substance were obtained when the Friese[7] method for the sulfonation of hydroaromatic hydrocarbons was applied with some modification to the sulfonation of cholesterilene. Using the Shipley technique for the "line" test, protocols were obtained showing degrees of calcification induced by the substance made by various modifications of the Friese method.

If the active substance is a sulfonic acid it should be soluble in water and precipitated by barium. In fact, addition of barium hydroxide or acetate solution to the water soluble acid residue remaining after the evaporation of the acetic acid solvent precipitated a crystalline barium salt. This was filtered off, dried, digested in alcohol, dissolved in carbon tetrachloride and reprecipitated in alcohol. The precipitate was dried at 100° C. The percentage of barium in three such preparations was 13.38, 13.21 and 13.18 and of sulfur, 5.94, 6.16 and 6.28, respectively. The calculated percentages for barium cholesterilenesulfonate $(C_{27}H_{43}O_3S)_2Ba$ are: barium 13.31 and sulfur 6.21. This salt does not melt below 330° C.

Two of these analyzed preparations, 104.4 and 107.2, were converted into the free sulfonic acid by digestion with an equivalent of sulfuric acid and "line" tested in a qualitative way for antirachitic potency. A continuous ++ line of calcification was produced by 3 mg of the cholesterilene sulfonic acid.

Since the insolubility of the barium salt in dilute acid or alkalis indicated a possible formation of the corresponding calcium salt from the free sulfonic acid and the calcium-containing ration in the digestive tract, a preparation 110 of the calcium salt was also "line" tested. Preparation 110 contained 4.37 per cent. calcium and 6.68 per cent. sulfur. The calculated values for $(C_{27}H_{43}O_3S)_2Ca$ are: 4.27 per cent. calcium and 6.86 per cent. sulfur. This salt melts at 320 to 325° C. Its antirachitic potency compared well with its molecular equivalent of the free sulfonic acid.

The potassium salt was prepared from the barium cholesterilenesulfonate by double decomposition with a molecular equivalent of potassium sulfate. This salt melted at 277° C.

A more direct method for the preparation of cholesterilene sulfonic acid and its isolation as the alkaline earth salt is through the sulfonation of cholesterol by modifications of the Friese method. In a preliminary run a 66 per cent. yield of the crude calcium salt was readily obtained.

The cholesterilene sulfonic acid is almost tasteless, soluble in water and also in oils when dehydrated. The monovalent metal salts are generally soluble. The bivalent metal salts are tasteless, insoluble to slightly soluble in water and soluble under certain conditions in organic solvents and oils. Due to their relatively low antirachitic potency overdosage is difficult. However, marked purgative effects were noted with rats, receiving during a four-day period 125 mg of calcium cholesterilenesulfonate.

It was not an objective of this station project to develop another antirachitic substance and it is proposed through letters patent to protect the interests of the public from a promiscuous substitution of such an antirachitic for vitamin D before its pharmacological action is further investigated.

LESTER YODER

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Bills and F. G. MacDonald, *Jour. Biol. Chem.*, 68: 821, 1926; 72: 1, 1927.

[4] S. K. Kon, F. Daniels and H. Steenbock, *Jour. Am. Chem. Soc.*, 50: 2576, 1928.

[5] Data submitted for publication elsewhere.

[6] J. Mauthner and W. Suida, *Monatsch.*, 17: 29, 1896.

[7] H. Friese, *Ber.*, 64B, 2103–8, 1931.

BOOKS RECEIVED

American Association for the Advancement of Science: *Summarized Proceedings, June, 1929, to January, 1934.* Pp. vii + 1245. The Association, Washington, D. C.

KIRKPATRICK, EDWIN A. *Mental Hygiene for Effective Living.* Pp. xiii + 387. Appleton-Century. $3.00.

LEMON, HARVEY B. *From Galileo to Cosmic Rays.* Pp. xviii + 450. Illustrated. University of Chicago Press. $3.75. With stereoscope, $4.50.

ROBERTS, MICHAEL and E. R. THOMAS. *Newton and the Origin of Colors.* Pp. viii + 133. Illustrated. G. Bell and Sons, London. 3/6d.

WIGGERS, CARL J. *Physiology in Health and Disease.* Pp. xxvii + 1156. 182 figures. Lea and Febiger. $9.00.

YATES, RAYMOND F. *Exploring with the Microscope.* Pp. xv + 182. Illustrated. Appleton-Century. $2.00.